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COBALT DEFICIENCY IN HEREFORDSHIRE AND WORCESTERSHIRE

Part I: Field Observations

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INTRODUCTION

Since the discovery that cobalt deficiency affected lambs on a single farm near Bromyard in Herefordshire (Osborne, Patterson & Treanor, 1949), further work has been carried out on the same problem in north-west Worcestershire and north Herefordshire. Chemical analyses of soils from a relatively large number of farms in these areas has shown that a high proportion have a cobalt status either lower than, or equal to, the critical level recorded by Patterson (1946) for farms in the south-west of England.

The low cobalt status on the majority of farms was associated with some degree of unthriftiness in the lambs after weaning in July until December, but this was not universally the case, and on some of the farms there was no history of pine. The adult sheep were not affected, nor were the cattle, and almost all the farms showed a general high level of productivity, typical of the two counties in question. The sheep mortality on affected farms was low and in many instances the symptoms, in the more severely affected animals, suggested that parasitism was a complicating factor and this was confirmed by the ova counts determined on faeces from representative lambs.

The complexity of the clinical picture suggested that the significance of the cobalt figures obtained for soils could be best determined by animal experimentation. With this object in view experiments were carried out on a number of farms between 1949 and 1953.

EXPERIMENTAL PROCEDURE

The general plan of the experiments was as follows. On each farm two equal groups of lambs were taken, and one group was dosed every fortnight with 1 oz. of a solution, containing the equivalent of 14 mg. of cobalt as cobalt sulphate, and the other group served as a control. The groups were otherwise treated as part of the main flock. Treatment for worms was carried out at frequent intervals in order to exclude parasitism as a complicating feature of the experiment. Faecal samples were taken monthly from individual members of each group, and worm egg counts made, in order to give some indication of the worm burden, and the desirability of special treatment in cases in which Nematodirus eggs were present in large numbers.

Where there was no evidence of a significant Nematodirus infestation alternate dosing with phenothiazine and copper sulphate-nicotine sulphate was recommended with an interval of one month between treatments. When Nematodirus eggs were found in large numbers tetrachlorethylene was administered. If symptoms of diarrhoea became evident in association with a rise in worm egg counts more frequent dosing was carried out until there was a recession of symptoms and a diminution in the count.

In the first experiments the lambs were not grouped by sex but were taken completely at random. In later experiments it was thought advisable to ensure the same sex distribution in trial and control groups, and where possible 10 ewe lambs and 10 wether lambs were taken as a suitable number to include in each group.

Each lamb was numbered for identification in order that the progress of individual animals could be observed. In this way marked changes in weight due to causes other than the condition under investigation, such as blowfly myiasis, which might have interfered with the interpretation of results could be noted and, if necessary, excluded. Particular emphasis was placed on this in view of the relatively small difference in weight gain found in some of the earlier experiments.

The experiments were started between late May and mid July, and terminated in October or, if possible, later.

RESULTS OF EXPERIMENTS

The results of experiments carried out on nine farms are appended in Table I. It will be seen that in all cases the average weight of both groups increased during the period when they were under observation. On six of the farms it was noted that there was a definite advantage in the administration of cobalt to the lambs, the growth rate in this group being up to what would normally be considered a satisfactory level, when the control group showed a sub-optimal growth rate. On the other three farms no advantage could be seen and this was also a feature on a small number of other farms whose results are not recorded, despite a previous history of trouble similar to cobalt deficiency and a low or marginal soil cobalt level.

On the farms where cobalt treatment was effective the progress of individual members of the two groups showed interesting variation. In general a small proportion of the control group gained equally as well as the more rapidly growing members of the cobalt group. A majority of the deficient group gained less but still showed a positive increase, whilst a small proportion showed either an increase of a very few pounds only or lost weight. It thus became obvious that some animals were better able to adapt themselves than others to this partial deficiency of a necessary trace element.

In the later experiments when sex differentiation was carried out, the difference between the two groups was found to be greater in the male component than the female. This applied both where the males were castrated and in a single experiment where ram lambs were used.

In a single experiment in 1950 an attempt was made to assess whether there was any advantage in giving cobalt for

TABLE I
ANALYSIS OF EXPERIMENTAL RESULTS

(a) Farm and Year	(b) Sex	(c) Group and No. in Group	(d) Mean of Initial Weights	(e) Mean Gain	(f) Difference between means	(g) Standard error of (f)	(h) Value of t.	(i) App. average soil Cobalt figure (p.p.m)
M (1950)	Mixed	Cobalt (19)	58·7	26·0	11·1	2·72	4·08*	0·06
	,,	Control (18)	62·4	14·9				
N (1950)	Mixed	Cobalt (20)	72·15	17·3	6·3	2·45	2·57*	0·18
	,,	Control (18)	76·5	11·0				
M (1951)	Males	Cobalt (10)	60·8	37·1	8·5	1·68	5·05*	
	,,	Control (10)	56·9	28·6				
	Females	Cobalt (10)	55·7	31·5	2·6	3·05	0·85	
	,,	Control (10)	59·0	28·9				
	Total	Cobalt (20)	58·25	34·3	5·55	2·10	2·64*	
	,,	Control (20)	57·95	28·75				
N (1951)	Mixed	Cobalt (15)	63·3	38·7	Negative			
	,,	Control (15)	66·1	40·2	3·8	1·4	2·71*	
	,,	Co/Cu** (14)	68·8	44·0				
Tr (1951)	Males	Cobalt (8)	53·5	40·5	0·6	2·19	0·27	
	,,	Control (6)	50·3	39·9	5·1	2·09	2·44*	
	,,	Co/Cu** (8)	53·6	45·0				
	Females	Cobalt (12)	50·5	36·75	0·20	2·43	—	0·35
	,,	Control (12)	51·3	36·95	0·8	2·33	0·34	
	,,	Co/Cu** (12)	57·75	37·75				
	Total	Cobalt (20)	51·7	38·2	Negligible			
	,,	Control (18)	50·9	38·0	2·6	1·80	1·42	
	,,	Co/Cu** (20)	56·1	40·6				
V (1951)	Males	Cobalt (8)	61·6	39·1	6·85	4·39	1·56	
	,,	Control (8)	61·0	32·56				
	Females	Cobalt (12)	64·25	37·1	0·54	1·95	—	0·30
	,,	Control (11)	63·1	37·64				
	Total	Cobalt (20)	63·2	37·9	2·3	2·02	1·13	
	,,	Control (19)	62·2	35·6				
P (1951)	Males	Cobalt (10)	67·0	22·6	Negligible			
	,,	Control (10)	66·3	22·7				
	Females	Cobalt (10)	66·5	22·7	,,			0·20
	,,	Control (10)	65·0	20·7				
	Total	Cobalt (20)	66·75	22·65				
	,,	Control (20)	65·65	21·70	,,			
Th (1952)	Males	Cobalt (10)	67·4	41·0	8·80	4·1	2·15*	
	,,	Control (11)	70·9	32·2				
	Females	Cobalt (10)	58·6	39·1	5·70	3·1	1·83	0·08
	,,	Control (9)	59·7	33·4				
	Total	Cobalt (20)	63·0	40·05	7·30	2·4	3·04*	
	,,	Control (20)	68·85	32·75				
L (1952)	Males	Cobalt (10)	59·1	40·7	8·80	3·6	2·44*	
	,,	Control (10)	61·0	31·9				
	Females	Cobalt (10)	54·5	31·7	0·70	2·7	0·26	0·20
	,,	Control (10)	57·0	31·0				
	Total	Cobalt (20)	56·8	36·2	4·75	5·5	0·86	
	,,	Contrll (20)	59·0	31·45				
AN (1953)	Males (Rams)	Cobalt (10)	68·9	25·3	9·50	3·73	2·54*	
		Control (9)	69·1	15·8				
	Females	Cobalt (9)	70·3	25·1	1·30	3·95	0·33	0·24
	,,	Control (9)	69·3	23·8				
	Total	Cobalt (19)	69·6	25·2	5·40	2·88	1·88	
	,,	Control (18)	69·2	19·8				
L 2 (1953)	Males	Cobalt (10)	55·5	32·9	16·00	4·30	3·72*	
	,,	Control (10)	56·4	16·9				
	Females	Cobalt (10)	54·2	30·4	11·10	3·41	3·48*	0·24
	,,	Control (10)	54·1	19·3				
	Total	Cobalt (20)	54·85	31·65	13·55	3·57	3·80*	
	,,	Control (20)	55·25	18·1				

* Significant at 0·05 level.

** This group dosed with proprietary pill stated to supply 32 mg. cobalt, 63 mg. copper, 200 mg. iron and 32 mg. manganese at fortnightly intervals.

Unless otherwise stated males = wether lambs.

a long period before weaning, and the results (Table II) suggested that such a procedure was of some value and later experiments were therefore commenced as early as was practicable for the farmer.

In the majority of experiments, and especially in those carried out in the early stages of the work, the differences between the treated and control animals were not so great as to be patently conclusive, and the results were therefore subjected to a statistical examination.

STATISTICAL INTERPRETATION OF RESULTS

The statistical methods applied for the testing of differences between mean values was the standard method for small samples according to which the difference between two means is compared with the standard deviation for such differences calculated according to the formula

$$\sigma_\Delta = \sqrt{\frac{n_1 s_1^2 + n_2 s_2^2}{n_1 + n_2 - 2} \cdot \frac{(n_1 + n_2)}{n_1 n_2}},$$

TABLE II
ANALYSIS OF EXPERIMENTAL RESULTS

(a) Farm and Year	(b) Sex	(c) Group and No. in Group	(d) Mean of Initial Weights	(e) Mean Gain	(f) Difference between means	(g) Standard error of (f)	(h) Value of t.	(i) App. average soil Cobalt figure (p.p.m)
H (1950)	Males	Cobalt Early (11)	46·4	54·0	6·6	4·5	1·47	
	,,	Control (13)	52·4	47·4				
	,,	Cobalt Late (12)	52·4	51·1	3·7	4·4	0·84	
	Females	Cobalt Early (9)	41·0	51·6	4·6	5·03	0·91	0·25
	,,	Control (6)	51·7	47·0				
	,,	Cobalt Late (8)	48·1	46·0	1·0	3·92	0·26	
	Total	Cobalt Early (20)	44·0	52·9	5·6	3·13	1·79	
	,,	Control (19)	52·2	47·3				
	,,	Cobalt Late (20)	50·8	48·9	1·6	3·03	0·53	

N.B. Dosing with Cobalt Sulphate was commenced in the early group on 26/5/50 and in the late group on 24/7/50.

where s_1, s_2 are standard deviations, in two samples n_1, n_2 animals respectively.

Significance of the ratio

$$\frac{\text{difference between means}}{\sigma}$$

is tested by using Student's t test with the appropriate number of degrees of freedom which is $n_1 + n_2 - 2$.

Considering, however, that the results are not completely consistent either with regard to the difference that sex might have upon the weight gain, or the difference that the soil cobalt figure might have upon that result, it seems desirable to combine the results and obtain over-all figures from them. A method of combining results of this kind recommended by Goldberg (1950) is as follows :—

" If the sum of the t values from samples one wishes to combine are added and divided by the square root of their number, the result, which we will denote by X_1, is approximately normally distributed with unity standard deviation. Its significance is tested as an ordinary Student's t with an infinite number of degrees of freedom under the assumption that the differences from which t was obtained are independent from one another." In the present case it seems of interest to group the experiment first according to the sex of the animal and calculate X for each of the two groups, we then obtain :—

TABLE III

	1951	1952	1953
X_M	4·11	3·25	4·44
X_F	0·37	1·49	3·81

It thus appears that the over-all figure concerning the gain in weight in males is significant throughout, since it exceeds 2, whereas for females it is significant only in 1953.

The next grouping of experiments was made according to soil cobalt figure especially where it was smaller than 0·25 and equal or greater than 0·25. This grouping was carried out only for males, because only for them did the results seem consistent enough to warrant comparison with regard to the soil figure. We then obtain as X_M ($<0{\cdot}25$) = 6·5 and X_M ($>0{\cdot}25$) = 2·07. The former is significant even at the 0·01 level, the latter only at the 0·05 level.

If the data for late and early administration (see Table II) are combined in the way described above, we obtain for $X_E = 1{\cdot}68$ and $X_L = 0{\cdot}774$. Although neither of them is significant the greater X for early application might be taken as an indication of its greater efficiency.

General Discussion

In 1949 the experiments were not carried through completely and rather served as pilot trials for the better planning of those in succeeding years. It was noted, however, that there was no suggestion of difference between cobalt treated and control groups even on farm M* where a significant difference was later demonstrated in 1950 and 1951. It was particularly noticeable that in 1949 the summer was exceptionally dry, the total rainfall for the months June to September inclusive being 52 per cent. of normal. These observations suggest that the problem in this area may well be similar to that described by Lee (1949) in South Australia. In certain areas he noted great variation in the response to cobalt from season to season, a condition which he describes as incipient cobalt deficiency. He makes the suggestion, based on evidence obtained in many years' observations, that the condition is more severe in years in which a dry winter is followed by a wet spring. Our observations do not lead us to make such a definite statement, but there is reason to support the suggestion that the condition is most severe when a combination of rainfall and warmth results in generous growth of pasture throughout the spring and summer. This observation is in accord with the finding of McNaught & Paul (1939) that the cobalt content of the herbage is lowest when the growth is greatest. Unfortunately, it was not possible to repeat the experiment on the same property in successive years except in a few cases. Such repetition might have given more information had it been carried out on a wider scale.

Such variations, however, do not explain the difference in response of lambs to cobalt on farms with apparently similar soil cobalt content, and we are therefore not completely satisfied that soil cobalt estimation alone is sufficient evidence for stating that cobalt deficiency symptoms will appear in animals grazing the sampled area. The extremely small amounts of cobalt present—the generally accepted minimum " safe " figure being 0·25 parts per 1,000,000 for soil—means that a chemical method must be carried through with a very high degree of accuracy. Spectrographic analyses may be more reliable but do not always give results comparable to the chemical method on the same soil sample. For instance, four fields on farm M gave the following results by the two methods.

Cobalt content ($2\frac{1}{2}$ per cent. acetic acid extract), p.p.m.

Field	Chemical estimation	Spectrographic Estimation
A.	0·13	0·36
B.	0·16	0·27
C.	0·30	0·46
D.	0·25	0·30
Averages	0·21	0·35

* See Table I.

The composition of most soils varies considerably even over a small area and great care is necessary in obtaining representative samples. Like A. M. Smith *et al.* (1952) who report as great a range as 0·05 to 0·31 p.p.m. cobalt in 24 samples taken from a very small area of hill grazing, we have found marked differences between adjoining fields on the same farm. It seems important, therefore, to take a fairly large number of samples covering the whole area involved and afterwards to reduce to a sub-sample by the method of quartering.

On those farms where negative results were obtained, only a proportion of which are indicated in the tables, it was almost invariably noted that both cobalt and control groups thrived equally well, and in general quite satisfactorily. The only explanation we can put forward to account for this is that a much more thorough anthelmintic regime was adopted during our presence, with the result that what may well have been merely a manifestation of sub-clinical parasitism was prevented. The anthelmintic dosage routine described was normally successful in keeping worm egg counts within limits which are normally accepted as " safe."

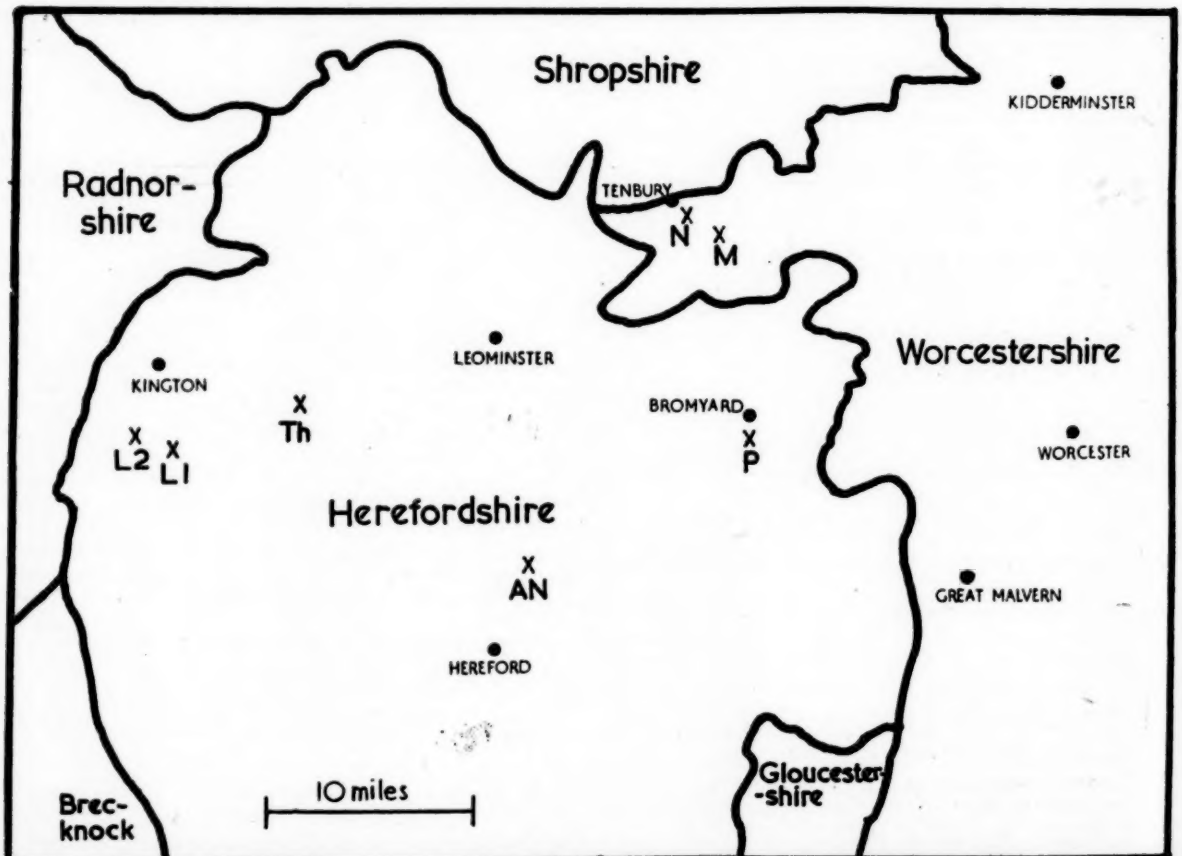
Two points appear to warrant further consideration, the first is the possibility of an associated deficiency of a second element, and the second the association of parasitism and cobalt deficiency. With regard to the former the results on farm N (1951) and farm Tr (1951) with a compound pill suggested that the addition of copper, manganese and iron was having an additional effect. This work was not continued, however, in view of the obvious need to confirm the main suspicion before bringing in other complicating factors. Limited examinations of blood samples and pasture samples did not support a suspicion of an associated copper deficiency in the " pining " lambs.

The question of an increased susceptibility to the effects of worm infestation in cobalt deficient lambs is one which on general grounds, based on observations and results of faeces examinations, we consider to be worth examining under more closely controlled conditions than is possible on the average commercial farm.

Summary

The presence of a cobalt deficiency affecting the growth of lambs has been confirmed on a small number of farms scattered over a wide area of North Herefordshire and North-West Worcestershire. It should, however, be emphasised that in no case could the severity of the condition be compared with that in South-West England or many other areas where the condition has been recorded, and that, whilst there may be seasonal variations, it was impossible to confirm the condition on some farms with a marginal or low soil cobalt figure.

Controlled experiments on the effect of cobalt added to the diet of lambs were carried out in successive years. Using the weight gain as a criterion of the effect of additional cobalt there appeared to be a different susceptibility of animal according to sex, the difference in weight gain of males on the same farm being more pronounced and reaching in general the level of statistical significance, whereas that for females was only significant in an exceptional case (1953).



Map showing approximate position on which cobalt deficiency has been confirmed by animal experiment. P identifies farm referred to in the original papers by Osborne, A. D., *et al.* (1950).

The limitations of the methods used for the determination of soil cobalt were explored. The results obtained confirm the view that 0·25 p.p.m. should be regarded as the critical level for soil.

Acknowledgments.—Much field and laboratory help was supplied by Messrs. C. D. Rickaby and T. W. Griffiths, Assistant Nutrition Chemists, in the course of these experiments, and we are deeply grateful to them. We are indebted to the Ministry of Agriculture and Fisheries, through Dr. A. W. Stableforth, for a small grant which enabled us to carry out some of the experiments recorded. Our thanks are also due to J. B. E. Patterson for advice and help, to the following veterinary surgeons, Messrs. J. H. Blanchard, D. McLeod, J. N. Peatt, J. F. Ryan and G. A. Treanor, for access to the farms and general encouragement and help, and to the farmers concerned, without whose assistance this investigation could not have been carried out. Rainfall figures throughout the period were kindly supplied by Miss D. W. Hutchinson.

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Part II: Laboratory Investigations

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In the autumn of 1952 it was thought possible that the apparently contradictory results obtained up to that time by Osborne, Featherstone and Herdan might leave room for doubt as to whether the condition being investigated was, in fact, a cobalt deficiency. For this reason, in November, 1952, the opportunity was taken of making a series of more detailed observations on three eight-month-old Kerry Hill wether lambs and one similar ewe lamb from the farm M above. All of these lambs were showing prominent and exaggerated symptoms of the "pining" condition described above. They were brought to Bristol University Veterinary Field Station, individually penned, and fed a daily ration of 200 g. of hay, 300 g. of a concentrate mixture and 1,200 g. of swede. The concentrate mixture consisted of three parts by volume of oats, one part barley, one part peas, one part beans and six parts flaked maize, and with the exception of the flaked maize, all of these components, together with the hay and swedes, were grown on farm M. Since the lambs at this time averaged only 44 lb. in weight, this ration should have been sufficient to satisfy their immediate needs for growth. The lambs were weighed thrice weekly and food intakes were measured daily.

Dr. R. L. Mitchell, of the Macaulay Institute, kindly analysed samples of the hay and concentrates and reported that they contained 0·06 p.p.m. cobalt and 86 p.p.m. iron, and 0·07 p.p.m. cobalt and 122 p.p.m. iron, respectively.

Faecal worm egg counts were made for each lamb upon arrival at Langford and since these showed a uniformly heavy infestation (see Table I) no cobalt treatments were given until the anthelmintic treatments had been concluded. Table I shows how successive doses of phenothiazine, copper and nicotine sulphate, and tetrachlorethylene at last reduced the parasite burden to reasonable limits. It was found, however, that this reduction in parasites resulted in no parallel increase in bodyweight or appetite in any of the animals. At this point, therefore, the study of the suspected cobalt deficiency began. Marston & Lee (1952) have reported that the administration of vitamin B_{12} effectively cures cobalt deficiency, since the cobalt is needed only by the microbial symbionts in the rumen in order that they may synthesise the vitamin B_{12} that is essential for the host sheep. It was therefore decided to treat wether lamb No. 1 with this vitamin and thrice weekly a dose of 100 μg. of vitamin B_{12} was injected into its gluteal muscles. The management of the other three animals remained unaltered. For the eight weeks prior to this treatment, lamb No. 1 had increased its bodyweight by 3 lb.; in the first eight days after the treatment it increased by a further 3 lb. In order that further possible beneficial effects of the vitamin therapy should not be masked by a restricted food intake, the amount of the concentrate mixture offered to lamb No. 1 and the three controls was now increased. The feeding method previously used in cobalt deficiency studies by Phillipson & Mitchell (1952) was adopted; the amount of concentrates offered to a lamb one day was always

Table I

Worm Egg Count Results Expressed in Eggs per Gramme of Faeces (Gordon Whitlock Technique)

Sheep No.	19/11/52	22/11/52	8/12/52	10/12/52	16/12/52	18/12/52	30/12/52	31/12/52	6/1/53	28/1/53	24/4/53
1	1300 S*	17 g. Phenothiazine given *per os.*	1150 S	1% Copper Sulphate / 1% 40% Nicotine sulphate — 2 ozs.	1800 S	4 c.c. Tetrachlorethylene	250 S	30 g. Phenothiazine	300 S	200 S	300 N 350 S
2	1150 S		1650 S		1200 S		0		250 S	50 S	50 S
3	2650 S		1400 S		2800 S		100 S		450 S	750 S	100 N 850 S
4	1300 S		600 N† 2800 S		100 N 2400 S		150 S		500 S	250 S	200 N 100 S

* S = Strongyle species.

† N = Nematodirus.

100 g. in excess of the amount that it had eaten on the previous day. The daily ration of hay and swedes remained unchanged.

The amount of concentrates now consumed by lamb No. 1 was considerably in excess of that consumed by the other lambs (see Fig. 1) and its bodyweight continued to increase for the rest of the experiment (see Fig. 2). Wether lamb No. 4 and the ewe lamb No. 2 were both maintained on this feeding routine for 23 days during which time their intakes of concentrates often fell to less than 200 g. and their bodyweights fell by 2 and 1 lb. respectively (see Figs. 1 and 2). At the end of this period both these animals were treated weekly with the equivalent of 7 mg. cobalt, as cobalt sulphate, administered *per os* thrice weekly. Immediately appetites and bodyweights increased sharply.

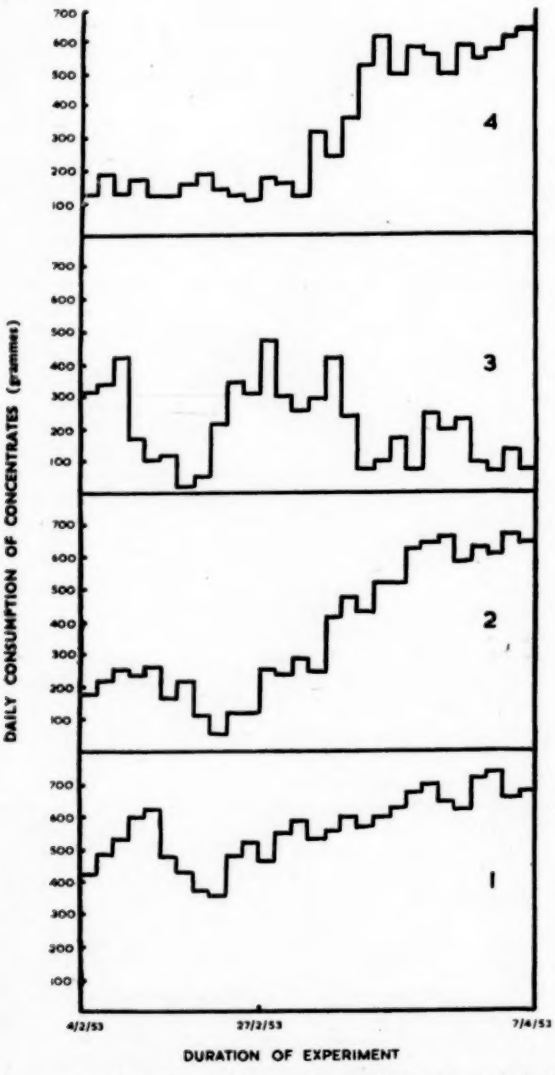

Fig. 1.—To show daily intakes of concentrates by each lamb. (Cobalt first given to Nos. 2 and 4 on 27/2/53).

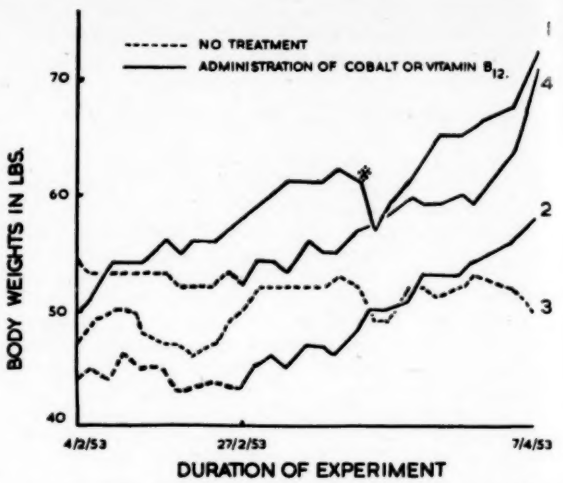

Fig. 2.—To show the bodyweight changes of each lamb. * At this point lamb No. 1 suffered from colic for four days and consequently showed a temporary decline in weight.

During all this time wether lamb No. 3 had been maintained on the same feeding routine as the other lambs but was given no special treatment of any kind. This routine was maintained until April 8th, 1953. On November 19th, 1952, wethers Nos. 1 and 3 both weighed 45 lb., on January 6th, 1953, *i.e.*, when vitamin B_{12} was first administered to No. 1, they both weighed 48 lb., on April 8th, 1953, they weighed 71 and 53 lb. respectively.

These results clearly indicate that these four lambs were suffering from a deficiency of cobalt, and that this condition was complicated on the farm by a considerable infestation of internal parasites. The fact that the deficient animals at least managed to maintain their bodyweights, and that even before cobalt or vitamin B_{12} was administered, they had haemoglobin levels of between 7 and 10·5 g. per 100 ml., suggests that the deficiency was of only a borderline nature. Nevertheless, the rapid improvement in the condition of the lambs after cobalt or vitamin B_{12} administration demonstrates how seriously production may be limited by a deficiency of this nature.

Summary

It has been confirmed that four lambs from Worcestershire were suffering from a borderline cobalt deficiency. This was cured either by injections of vitamin B_{12}, or by the oral administration of cobalt.

Acknowledgments.—Grateful thanks are due to the owner of farm M for the loan of the lambs, and to Miss J. Woolley and Mr. G. Crook for skilful technical assistance and help in the management of the animals.

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Photograph of Professor Buxton

A characteristic photograph of the late Professor J. B. Buxton, taken in the grounds of Streatley House, was published in *The Field* in 1951. Copies are still obtainable ranging in price from 3s. 6d. to 25s. according to size.

Orders may be placed direct with The Picture Editor, "The Field," 8, Stratton Street, London, W.1.

THE EFFECT OF ETHIDIUM BROMIDE ON EARLY TRYPANOSOMIASIS CAUSED BY *T. CONGOLENSE* IN ZEBU CATTLE USING A STANDARD DOSE IRRESPECTIVE OF LIVE WEIGHT

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VETERINARY RESEARCH LABORATORY, MPWAPWA, TANGANYIKA

INTRODUCTION

Watkins & Woolfe (1952) first described the activity of ethidium bromide (2:7 diamino-9-phenyl-10-ethyl-phenanthridinium bromide) against trypanosomiasis in mice. The activity of ethidium bromide against *T. congolense* in cattle was described by Wilde & Robson (1953) in Tanganyika, by Wilson & Fairclough (1953) in Kenya, and by Ford, Wilmshurst & Karib (1953) in the Sudan. These authors all used dosage rates based on live weight, whereas in this experiment it was decided to try the effect of a single dose irrespective of live weight as, should this prove successful, it would greatly facilitate the administration of the drug in the field. A supplementary experiment was carried out to determine whether ethidium bromide administration would have any effect on live weight. This was done because of a comparative beef experiment being run in Tanganyika, one part of which is carried on in a light tsetse-fly area where the cattle may have to be treated with ethidium bromide.

METHODS

The experiment was carried out at Mpwapwa using a strain of *T. congolense* obtained from a naturally occurring case at Godegode, an area where no trypanocidal drugs have been used. The blood was collected and inoculated into laboratory goats, and blood from these goats was used to infect cattle. The experiment was initiated in September, 1953 and continued until the end of January, 1954.

One hundred Zebu cattle of varying weights and ages were assigned at random into five groups as follows:—

Group (*a*) 20 animals. Received infected blood and later 0·25 gm. ethidium.

Group (*b*) 20 animals. Received infected blood and later 0·15 gm. ethidium.

Group (*c*) 20 animals. Received infected blood.

Group (*d*) 20 animals. Received 0·25 gm. ethidium.

Group (*e*) 20 animals. Received no infected blood and no ethidium.

The cattle had no histories of previous infection with trypanosomes and were infected with 4 ml. infected goats' blood.

Six days after all 60 of the cattle had shown positive blood slides, groups (*a*), (*b*) and (*d*) were given ethidium bromide. Groups (*a*) and (*d*) received 0·25 gm. ethidium in 10 ml. aqueous solution, and group (*b*) 0·15 gm. ethidium in 6 ml. aqueous solution. All injections were given subcutaneously behind the shoulder. The majority of the animals showed some slight local reaction but in only three cases, all in group (*a*), did a slough develop at the site of inoculation.

All the cattle were weighed at the time of infection and at weekly intervals thereafter until the end of the experiment. Thick blood slides were taken on three mornings each week and examined after staining with Giemsa.

The cattle were run as one herd on tsetse fly-free grazings, and no cases of natural or cross-infection were found in the animals of control group (*e*).

RESULTS

On the ninth day after infection 17 cattle out of the 60 infected showed positive blood slides; on the 11th day 59, and on the 12th day all 60.

At intervals after treatment, blood slides from five animals in group (*a*) and five in group (*b*) were examined. All these animals showed positive blood slides on the morning of treatment, and the subsequent results are shown in Tables I and II.

TABLE I
DISAPPEARANCE TESTS
GROUP (*a*) 0·25 GRAMME ETHIDIUM

No. of Animal	Blood Slide after Treatment			
	5 hours	21 hours	25½ hours	29½ hours
70	+	+	—	—
83	+	+ breaking up	—	—
86	+	—	—	—
111	+	+ breaking up	+	—
184	+	+	—	—

TABLE II
DISAPPEARANCE TESTS
GROUP (*b*) 0·15 GRAMME ETHIDIUM

No. of Animal	Blood Slide after Treatment			
	5 hours	21 hours	25½ hours	29½ hours
87	+	+	+	—
92	+	+	—	—
99	+	+ Breaking up	—	—
160	+	+	—	—
177	+	+	+	—

The period September to December, 1953, marked the height of one of the worst droughts ever suffered at Mpwapwa. Grazing was negligible and as no supplementary feed was given to any of the experimental animals, deaths inevitably occurred from malnutrition. Although many of the cattle were immature no single one gained any weight over the period of the experiment.

Table III gives the live weight variations at the time of infection and the resultant ranges in dosage rates of ethidium bromide, in groups (*a*), (*b*) and (*d*).

TABLE III
RANGES IN LIVE WEIGHTS AND DOSAGE RATES OF ETHIDIUM BROMIDE IN GROUPS (*a*), (*b*) AND (*d*)

Group	Average Weight	Weight Range	Dosage Rate Range
(*a*)	325·8 lb.	163—519 lb.	1·1 mg./kg.—3·4 mg./kg.
(*b*)	353·0 lb.	196—628 lb.	0·5 mg./kg.—1·7 mg./kg.
(*d*)	352·1 lb.	189—652 lb.	0·8 mg./kg.—2·9 mg./kg.

The cattle in control group (*c*) all remained infected, and the first one died from acute trypanosomiasis on the 42nd day after infection. By the 52nd day nine had died of trypanosomiasis and in the interests of economy 10 of the remaining 11 cattle in this group were treated with 0·25 gm. ethidium bromide administered subcutaneously in

10 ml. aqueous solution. The last remaining control animal died on the 56th day after infection showing typical signs of trypanosomiasis. The 10 treated animals all showed trypanosomes in their blood on the morning of treatment, and following treatment blood slides were examined at short intervals. Trypanosomes had disappeared from the blood of all 10 animals by 25 hours after treatment.

At the conclusion of the experiment, 125 days after treatment, none of the treated cattle in groups (*a*) and (*b*) had shown any signs of relapse: *i.e.*, no trypanosomes could be demonstrated by thick blood slide examination. Of the animals treated in group (*c*), at 90 days after treatment none had shown any signs of relapse.

Deaths had occurred in the various groups but none of these, other than in group (*c*) could be attributed to trypanosomiasis, practically all being due to malnutrition exacerbated by helminth infection. In group (*a*) seven animals died, in group (*b*) four, in group (*d*) four, and in group (*e*) three. In group (*c*) three animals died after treatment.

The average weight loss of each group is given in Table IV.

Table IV
Average Weight Losses of the Various Groups during the Experiment

Group	Infected with *T. congolense*	Dose of Ethidium given	No. of Survivors	Average weight lost during Experiment
(*a*)	Yes	0·25 gramme	13	51·8 lb.
(*b*)	Yes	0·15 gramme	16	54·1 lb.
(*c*)	Yes	nil	7	87·0 lb.
(*d*)	No	0·25 gramme	16	37·2 lb.
(*e*)	No	Nil	17	41·7

Van der Bergh tests were performed on 10 cattle from group (*a*) on 10 occasions from the 25th day after treatment until the 56th day, and only on one occasion was one animal positive. This animal died two days later from tympanitis. On all other occasions both direct and indirect tests were negative.

Discussion

From the results obtained in this experiment it can be seen that, as far as can be determined by thick blood slide examination, 0·25 gm. ethidium bromide cured average Zebu cattle from trypanosomiasis due to *T. congolense* when administered in the early stages. Ethidium bromide 0·15 gm. also cured; but as the manufacturers have produced the compound in tablets of 0·25 gm. it will be convenient to use this as a standard dose in the field.

Table IV shows that those cattle infected but not treated lost most weight, whereas those which had been given the drug alone or were uninfected and untreated lost least, the infected treated groups being intermediate.

Summary

Ethidium bromide was tested against trypanosomiasis caused by *T. congolense* at two dosage rates irrespective of live weight, treatment being given six days after all infected cattle showed positive thick blood slides. None had relapsed by the 125th day after treatment. Untreated controls proved the strain of *T. congolense* to be fully virulent.

The results of disappearance tests and weight losses are tabulated.

Seven cattle were still free from trypanosomes in the peripheral circulation 90 days after treatment, having been treated 53 days after infection.

It is concluded that 0·25 gm. ethidium bromide used in the early stages of the disease caused by *T. congolense* is a suitable and safe standard curative dose for Tanganyika Zebu cattle.

Acknowledgments.—We are grateful to Mr. G. W. Walker, B.Sc., A.R.I.C., of this Laboratory for carrying out the Van der Bergh tests, and the Director of Veterinary Services, Tanganyika, is thanked for permission to publish our results.

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Watkins, T. I., & Woolfe, G. (1952). *Nature.* **169**. 506.
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CLINICAL COMMUNICATION

ACETONAEMIA IN A LITTER OF SAMOYED PUPPIES

J. McLintock and G. T. Wilkinson
Norwich

Subject.—Six four-weeks-old Samoyed puppies.

History.—The puppies had apparently been normal until two days before professional assistance was summoned, when the owner noticed that they seemed to have difficulty in using their hind legs. The symptoms were apparently progressive in severity and advice was sought.

Examination.—The affected puppies were lying together looking listless and dejected and making more noise than usual. Closer examination revealed that all of them were making slight, rapid nodding movements of the head, and their bodies also showed muscular tremors. When made to move, a severe ataxia was apparent, amounting almost to a paraplegia in one or two of the animals.

Clinical examination showed that the pupillary and corneal reflexes were normal but that there was a diminished pedal reflex in the hind legs. All the puppies had very bloated abdomens which felt more solid than tympanitic. It was noted by one of us (J. McL.), that there was a strong smell of acetone in the breath of them all.

Diagnosis.—A diagnosis of acetonaemia was made, and enquiries were pursued to elucidate the possible etiology of the condition.

It appeared that the owner had been dosing the bitch very frequently with cod-liver oil as a protection against rickets. The bitch was producing a very abundant supply of milk and the puppies were also getting an addition of cod-liver oil to their ration daily and for the last few days had been given some minced mutton fat as solids.

It would appear, therefore, that the acetonaemia was due to an excess of fat in the diet with consequent severe fatty infiltration of the puppies' livers. The enlarged liver could actually be palpated in their swollen abdomens.

Treatment.—A very guarded prognosis was given in view of the advanced state of the condition. Treatment was aimed at limiting the fat intake of the diet and increasing the oxidation of the fats already deposited in the liver.

The owner was instructed to administer glucose and water, and the puppies were also given a saturated solution of sodium bicarbonate, at the rate of one drachm t.i.d., in an attempt to neutralise the acidosis. Glucose saline

was also injected subcutaneously and vitamin B_{12} intramuscularly.

The bitch was only allowed to be with the puppies for very short periods and all fat was excluded from her diet as far as possible. The puppies were put on a diet of minced raw meat, liver, glucose, water and skimmed milk.

Within two days, one of the puppies died, and *post-mortem* revealed a grossly enlarged, clay coloured liver, which imparted a greasy smear to the knife when cut.

Another puppy died in a week's time, but the remainder showed a gradual improvement as time went on. The nodding movements were the first symptom to disappear, the ataxia slowly decreasing until the gait was apparently normal. The animals became much more lively and recommenced to grow, although they appeared to be very stunted when placed beside a normal litter of the same age.

Further recovery was uneventful with the exception of one puppy whose abdomen remained rather bloated. Paracentesis abdominis was performed and nearly a pint of milky-white transudate was withdrawn. (Chylous ascites?). After this operation, the puppy made rapid headway. All puppies were apparently normal at four months old.

Discussion.—This case is recorded as there are apparently no other records of this condition in puppies. It is interesting to note the similarity between the symptoms displayed by the puppies and those shown by cattle affected with the nervous form of acetonaemia. In the case of the puppies, however, there was no evidence of delirium.

SUMMARY

1. Acetonaemia, due to excessive fat intake in the diet, in a litter of Samoyed puppies is recorded.

2. Restriction of fat intake and measures to increase fat oxidation were successful in restoring to health four out of the six animals affected.

ENDEAVOUR TO REAR A BABY GIRAFFE

BY

O. G. JONES,

CURATOR OF MAMMALS, ZOOLOGICAL SOCIETY OF LONDON

Quite recently a baby was born to " Maggie " a Reticulated Giraffe in the London Zoo. The gestation period of this species is somewhere between 426 and 468 days (Kenneth) and since on this occasion service was not witnessed, the precise date of calving was unknown. It was interesting, therefore, to observe the usual clinical symptoms of approaching parturition and endeavour to estimate a calving date. It was noticed on January 23rd that there was vulval enlargement and a restless attitude. There was no mammary enlargement but there appeared to be abdominal movement. Comparing these signs with the domestic cow one was fairly confident that parturition was imminent and a 24-hour staff was arranged. After a week it was obvious that the estimate was wrong and ordinary staffing was resumed. The vulval enlargement continued slowly for the next seven to eight weeks, during which time the sacral muscles began to relax so that the pelvic region took on something of a " hat rack " appearance. Abdominal movement was quite violent at times and shook the whole frame of the mother. A week before Derby Day mammary enlargement suddenly occurred and this seemed surely to be a firm indication that parturition was close. At 6 a.m. on Derby Day " Maggie " gave birth to a male baby. The birth was in every way normal and unassisted. The foetal membranes were passed two hours later, and the mother paid the normal post-natal attentions to her child. " Derby," as he was christened, was standing on his feet within half an hour of birth and was a fine healthy baby standing 5 feet 10 inches high at the poll.

" Maggie " had always been a nervous, restless beast and since this was her first baby perhaps it was to be expected that although she had given it excellent attention at birth she now became frightened of her own child and refused to allow it to approach her although it made frequent attempts to do so in order to suckle. Any attempt by " Derby " to have his first meal was greeted with kicks from his mother's hind leg or fore-leg, and this formidable exhibition was viewed by the veterinary officer with grave concern. The decision had to be made whether to leave this rare baby with his mother and hope that she would settle down—and by so doing risk the child's death from a vicious kick, or immediately to separate the two and face the difficulties of artificial rearing. It was decided that the former course was proper, at any rate for 24 hours. The situation was reviewed the next morning and it seemed that " Maggie " had settled down somewhat since by this time " Derby " was allowed to prehend a teat but was still not allowed to suckle. A further 24 hours' grace was given to " Maggie " since it was deemed a justifiable risk in view of the importance to the child of the foremilk, and the possible difficulties of artificial rearing.

At the end of a further 24 hours, however, it became quite apparent that not only was " Maggie " unwilling to rear her child, but she had lost all interest in it and only wished to join the remainder of the herd. It was therefore decided to separate them and to attempt hand-rearing.

Not a great deal is known about the analysis of giraffe milk, but it was assumed that it would approximate to ordinary cow's milk. Advice was sought from Whipsnade and also from Belle Vue, where two youngsters had been artificially reared. It was discovered, however, that " Derby " seemed to have lost his suckling reflex and was only interested in biting the teat of the bottle.

Since it was estimated that such a baby probably would require quite a gallon of milk a day and bottle feeding was only supplying some few ounces of milk due to the difficulties mentioned, stomach tubing was resorted to with an estimated pint per feed every three hours. The baby, however, died quite suddenly on the fourth day. The *post-mortem* report put the cause of death as peritonitis, and observed that the animal had multiple gastric ulcers. The precise etiology of these is unknown.

It was interesting to note that during " Derby's " four days of life he increased in height from 5 feet 10 inches to over 6 feet.

Late Delivery of " The Record "

We have received a few complaints that *The Record* is not received by members of the Association until after its publication day—Saturday. The matter has been taken up with the Post Office who have asked to be notified of individual cases where delivery is late. The Editor would be most obliged, in the case of deliveries being made on Mondays, if members would kindly give him details, including, if possible, the post-marked wrappers.

THE VETERINARY RECORD
JULY 17TH, 1954

MEAT INSPECTION IN WESTERN EUROPE

THE tour recently carried out by a delegation consisting of two members of Parliament having different political loyalties, by Dr. Wooldridge and by Mr. Thornton was the latest move in the long campaign waged by the British Veterinary Association to bring the meat inspection services under the supervision of the Profession. Members of the Association will not be surprised that the delegates were unanimous in their opinion that " the meat inspection services in England and Wales should definitely be brought under veterinary control," but those whose work does not lead to first-hand information on the subject may have been surprised that, in all the Western European countries visited the standards of inspection and of hygiene, and the consequent protection of public health are so much superior to most of the standards here at home.

The evidence of the delegation is of so conclusive a nature, and is so widely substantiated in the Appendices to their Report that Parliamentary and public opinion must surely be moved at the discrepancy between our own precautions, and those widely practised abroad, to secure safe and wholesome meat and meat products. The recent de-rationing of meat, and the natural anxiety felt in many quarters—as instanced in our Parliamentary Report last week—about the conditions in newly opened and newly licensed slaughterhouses, gives a sharper point to these findings, and it is to be hoped that the valuable document produced by the Association and circulated to members with our last issue will not be pigeon-holed by authority, nor forgotten in a day by the mass of the people whose interests are so directly concerned in it.

The Profession's views in the matter of the supervision of meat inspection have at times differed from those of some medical officers of health and of the sanitary inspectorate; but there is some confusion of thought about what exactly it is that veterinary surgeons propose. In this connection part of the speech made by our President to the Veterinary Hygiene section of the Royal Sanitary Institute's Health Congress at Scarborough may be quoted. Mr. Thomson said:—

" I feel this is a particularly timely moment for us to discuss this matter of meat inspection together. As we all know, the derationing of meat is just round the corner. There will be additional slaughterhouses presumably, and marketing may to some extent take the form of beasts either going straight from the farm to the abattoir, or at least of their journey from the one to the other not being as long or as complicated as at present. There are those who see considerable advantages in such a thing, and if it comes about I feel that there will be work for which the veterinary surgeon is especially fitted. Everyone knows that a beast that is rested and calm produces better quality meat than one which is tired or harassed. It is the duty of some particular person or persons to say when is the right time for slaughter, and I put it to you that our opinion in that matter would surely be valuable. Our whole time is given to the study and care of animals, and in consequence it is surely true that the veterinary surgeon is better equipped than anyone else to say what state an animal is in.

" But there are wider considerations than these. I have spoken of the constructive nature of our work, and yet I believe we are the only body of technicians who, for the most part, have nothing to do with the finished product—in this case the animal at the point of slaughter. We tend it, we direct its diet where necessary for certain definite ends, we undertake research, and we put forward new thoughts on husbandry. Yet, at the finish, we do not have the opportunity of seeing what our work has amounted to, which can only be done by *ante-mortem* and *post-mortem* examination.

" Now surely, if you agree with me that the production of more and better home-grown food is of the most urgent importance, how can we play our part to the full when we see only half the picture? Is there not a strong and logical case for veterinary surgeons at the slaughterhouse who would be in a position to make liaison with their colleagues who are advising the farmer? We feel that all our researches are hampered and our advice is less effective when we have so few facilities for *ante-* and *post-mortem* examination.

" Let me repeat, if I may, a point I have made already. In suggesting the value of veterinary services at the abattoir my profession has no thought in mind that non-veterinary meat inspectors should be displaced. They have done and are doing very valuable work. It is only that such work, we feel, could be of still greater value had they more veterinary colleagues.

" There is just one other matter before I leave this subject of the inspection of meat. Within recent years the incidence of food poisoning has tended to increase, and it is brought about more often through meat and meat products than through any other medium. There is a growing work, I venture to suggest, for members of the Royal Sanitary Institute to do, especially as most cases arise through organisms that become active after slaughter or in processing. Nevertheless, sources of food poisoning which could have been detected at the time of slaughter are not unknown. You may say that in cases of doubt you have recourse to the Medical Officer of Health. But I would reply that, while I pay tribute to the great sister profession of medicine, I feel that, just as a doctor knows more about a human being than I do, so, in turn, I and my colleagues know more about a sheep or a pig than he does."

It is difficult to understand what substantial objection there can be to this eminently reasonable and temperate viewpoint. The Report of the delegation which visited Western Europe certainly underlined it with facts that seem to be beyond argument.

This matter of meat inspection, important and indeed vital as it is, is but part of a larger principle. In many public matters, and upon many public and official bodies and committees the Profession is either not represented as it should be, or not represented at all. Our specialised knowledge, our researches, our experience are continually passed over when they have much to contribute that is not available from any other source. The British Veterinary Association has this matter constantly under review. It must be supported by the active and unanimous efforts of the Profession if we are to take our proper place, and receive the consideration that is our due at all levels in the national life.

ABSTRACTS

The Experimental Production of Hyperkeratosis in Young Calves by the Use of a Pentachlorinated Napthalene Compound

Hyperkeratosis of cattle was first reported in the U.S.A., where it was known as " X Disease," and identified as a toxic reaction to certain chlorinated naphthalenes. A hyperkeratosis of cattle has been observed in New Zealand, and its association with the use of a pentachlorinated naphthalene wood preservative was the object of this investigation. Calves, one week old, were dosed daily with capsules containing 2 grammes of the wood preservative, or painted on the neck with 0·25 to 0·5 grammes of the compound dissolved in kerosene. These treatments were continued for 16 to 25 days. The calves were weighed daily, the blood vitamin A estimated, and the citric acid content of the blood was determined for evidence of liver damage. The toxic reaction which followed the use of the wood preservative, was manifested by lachrymation, blindness, anorexia, depression, diarrhoea, and hyperkeratosis. One calf died after being dosed for 16 days, and the remainder were destroyed 25 to 31 days after the start of the trial. The main lesions were an acute tubular nephritis, congestion and ulceration of the intestinal tract, and hyperplasia of areas of the dermal epithelium. Liver damage was not apparent, and the citric acid determinations did not produce significant results. A decline in the vitamin A levels was observed in all cases, but there was no response to dosage with 1,000,000 units of vitamin A.

D. W. J.

* **The Experimental Production of Hyperkeratosis in Young Calves by the use of a pentachlorinated naphthalene compound.** Dodd, D. C., & Hall, R. A. (1953). *N.Z. Vet.J.* **1.** 104–9.

* * * * *

The Effect on Cattle of Long-continued Cutaneous Applications of DDT

The purpose of this investigation was to examine the toxic hazard of the long-repeated use of DDT as a dip for the control of cattle ectoparasites. Groups of 18 steers and 16 heifers were treated weekly with a dermal application of 22·5 grammes of DDT in oil for three years. It was estimated that 22·5 grammes represented the amount which would be retained in the coat of a beast dipped in 0·5 per cent. DDT and a solution in oil was selected as the most suitable formulation for the percutaneous absorption of the DDT. The steers were weighed at weekly intervals during the period of the test and there was no significant difference between the growth rates of treated and untreated animals. At the end of each year some animals were slaughtered, and all the survivors were killed at the end of the test. No damage attributable to DDT was observed *post-mortem* even after histological examination of brain, spinal cord, heart muscle, bone marrow, liver, spleen, kidney, and skin from the area to which the insecticide had been applied. Portions of these tissues, together with samples of omental and dorsal fat, urine, bile and milk, were analysed for the presence of DDT which was found, mainly in the fatty tissues, in amounts of 50 to 425 p.p.m. DDT, although the amount of DDT in the milk did not exceed 3 to 4 p.p.m. Significant amounts of DDT were also recovered from the organs of untreated cattle pastured with the test animals which indicated that the insecticide had been picked up from the ground, or by contact with the treated beasts. No signs of DDT poisoning were detected in any beast at any stage, and the heifers bred normally. The authors conclude that repeated dipping in aqueous suspensions of 0·5 per cent. DDT would be without detriment to the health of cattle.

D. W. J.

* **Effect on Cattle of Long-Continued Cutaneous Applications of DDT.** Roulston, Hitchcock, *et al.* (1953). *Aust. J. Ag. Res.* **4.** 469–480.

NOTES AND NEWS

Diary of Events

July 23rd.—Meeting of the Yorkshire Division, B.V.A., in the Government Buildings, Crosby Road, Northallerton, 2.30 p.m.

July 28th.—Meeting of the Supplementary Veterinary Division, B.V.A., at 7, Mansfield Street, Portland Place, London, W.1, 2 p.m.

Sept. 19th—25th.—72nd Annual General Meeting and Congress of the British Veterinary Association at Torquay.

* * * * *

July Meetings of Council and Committees, B.V.A.

Wednesday, July 21st, 1954:—

11.0 a.m. Organising Committee.
2.0 p.m. Home Appointments Committee.
3.30 p.m. Parliamentary and Public Relations Committee.
At 7, Mansfield Street, Portland Place, W.1.

Thursday, July 22nd, 1954:—

10.30 a.m. Veterinary State Medicine Committee.
1.45 p.m. Finance Sub-committee.
2.30 p.m. General Purposes and Finance Committee.
At 7, Mansfield Street, Portland Place, W.1.

Friday, July 23rd, 1954:—

10.30 a.m. Council Meeting.
At the Connaught Rooms, Great Queen Street, W.1.

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PERSONAL

Birth.—Wilson.—On July 4th, 1954, at Cheriton Nursing Home, Swindon, to Elizabeth (*née* Ellis), wife of Peter Wilson, M.R.C.V.S., a son.

. . . . .

Engagement.—The engagement is announced between Michael Cawood Butler, B.Sc., M.R.C.V.S., son of the late Mr. and Mrs. H. C. Butler, of Camberley, Surrey, and Gertrude May Sanpher, eldest daughter of Mr. and Mrs. A. E. Sanpher, of Barton Bendish, Norfolk.

* * * * *

A Tribute to Professor J. B. Buxton

Dr. J. R. M. Innes writes:—

In the appreciation in the *Record* signed T. J. B., there are remarks which stand out as being worthy of the man who has gone from our midst. I refer to " the record of service to the profession which few can hope to equal," and many of his high personal qualities. It is a duty to add my contribution to those which have appeared about a man who for years was known to me, and many colleagues, as the Chief, yet in conversation between ourselves we referred to him as J. B. I had some claim to know him well, for he gave me my first opportunity to pur-

sue research (in 1926), and future work in pathology, in the Institute of Animal Pathology, Cambridge University, where I worked until 1940. I am thus well acquainted with the historical development of the Institute, and all the nearly 60 workers who had passed through, and under, J. B.'s command.

From the day I arrived in the I.A.P., I felt that here was a man whom we really knew to be the Chief, not only in name, but in person and in all he did. He fails in no way by comparison with his successors on any variety of standards. The appreciation by T. J. B. says he trusted his staff. That may have been one key to the happy relations built up by J. B., but I feel there was much more than that. In the very early days in Cambridge I can remember the great delight experienced by all the young members when the Chief walked into one's laboratory, sat down and talked. We felt honoured. He was never one to throw out praise, but when he did it was meant and treasured. He never chided, rarely criticised us or our efforts in work, never demanded results or papers, and only once in 10 years can I remember him being really angry (with me). We never received evasive replies, and all suggestions regarding work or any matter was decided upon with punctilious precision, and there was no procrastination. He certainly had a native shrewdness and wisdom far beyond his age at that time, and there was never any doubt who was Chief. He did everything in his power to look after his staff, made no distinctions and had no favourites amongst the younger people.

I do not intend to talk about his greatness and service to the profession, because this has all been covered elsewhere. My message is purely a personal one, based on an intimacy with him as Chief and Professor. He adorned the latter post in a most remarkable manner, for it may not be generally realised, until one contemplates, how young he was (35) when appointed to the Cambridge Chair. This was a most onerous task to thrust upon a young man, but he tackled it with imperturbable calm. To hold a chair in Cambridge at any time might baffle any older worker with a well-established repute in any science. For the occupant of the first Chair in a veterinary science (animal pathology) it must have been exacting to enter our oldest (?) and best (!) University, where College Dons and Professors traditionally had to be mellowed by age. This appointment had to be established, and secured for its perpetuity, under the critical eyes of the cream of British science. I have looked through the list of the handful of veterinary research workers of the early 20's, and there were not many, if any, who could have carried out what J. B. did. This is not said in any deprecatory sense of the calibre of his contemporaries; the choice was restricted, but too many had little scientific training and experience, and none possessed the personal qualities of J. B. He was required to enter a University as a Professor, meet and talk on equality, with men in Colleges and the University laboratories—men of the calibre of Lord Rutherford, Sir J. J. Thomson, Hopkins, Barcroft, T. B. Wood, Marshall, Sir Humphrey Rolleston, Drury, Grahame Smith, Nuttall and Sir Thomas Hardy, to mention a few out of dozens of stars who shone in the realms of many sciences then. He did all that with great dignity, plus unruffled geniality, and tacitly held his own at an age (35) when most men are just beginning to find their professional feet, and are not often mature as scientists. He established the Institute, gathered around him a small staff, the young members of which had had no previous training. It was necessary to impress the University authorities, the Ministry of Agriculture, the A.R.C., and M.R.C. that veterinary research was worthy of support at a period only emerging from that when we were regarded just as "vets." Buxton did this, amongst all the other activities T. J. B. writes about.

The Institute at that time was small, we had a fine rose garden in front (thanks to Col. Wood), life was leisurely, but there was just as much work done there as happens in many bigger Institutes in the U.S.A. to-day, in spite of reputed American pep and bustle. It was a happy place and the staff in 1926 consisted of Bosworth, Jamieson, Glover, Cornell, Leyshon, James Stewart, Allen, Col. Wood, with Thomson and Hughes as the senior technicians. Of these R. L. Cornell, W. Leyshon, Col. Wood and Thomson are deceased. All others came to occupy important positions, and R. E. Glover has recently been President of the R.C.V.S. Only the names of Lyle Stewart and Wooldridge (now President) are missing from that list of original workers when the Institute was started. The happiness and goodwill in that place were the result of the wisdom and personal make-up of J. B. His geniality and charm were best seen when being host, and workers in the Institute were expected to visit the Buxton house on Sunday afternoon for tea, when the grace of the Professor's wife helped to keep us all grateful for being in that delightful place in the Fens, and in that Institute. Many graduates from Britain and overseas worked under Buxton in the next 10 years, before he became Principal of the London College. Amidst the phlegmatic English type, J. B. recruited, and tolerated the vagaries of, men who belonged to the wild Irish, the argumentative pugnacious Scots or the wily Welsh, with a constant influx and going of Colonial and Dominion veterinarians. Out of all that total there are a great many who have reached eminent positions in the profession here and abroad. There is no doubt that J. B's influence helped them on their way. His greatness really lay, as T. J. B. says, in his powers of organisation and administration, he made no serious claims to be a pathologist or bacteriologist. Albeit, he was happy at a bench, and made important contributions on tetanus, botulism, tuberculin and BCG. He had vision regarding the great need for expanding the scope of a compact institute of veterinary research, and before many years had passed he had workers engaged in the fields of bacteriology, virology, protozoology, helminthology, biochemistry, physiology, animal nutrition, plant poisons, and pathology. Only one (myself) who had compiled a list of publications coming from the I. A. P. (from 1923-40) can realise the variety and scope of work covered, and the number of papers published—many outside strictly veterinary literature. Much of this arose by the encouragement of the Chief, and will last as a memorial to him. He had the most implicit faith in his staff, and once they were ensconced in a laboratory he never bothered them; he clearly believed that any young man worth his salt will take the trouble to learn, dig and forage for himself, and in the end do good work.

Many who worked in the I. A. P. during that period no doubt found occasion to criticise. Some of it might have been jealousy. No one, surely, will deny he was a good and wise Chief, that they may never have had a better one since, and that their days in Cambridge were the happiest in their lives. I speak for myself in that connection, and having twice now been in position of command of departments as large as, or larger than, the I. A. P., with the concomitant business of keeping peace and order amongst staff, I can understand better, and appreciate fully and well, the magnificent job J. B. did. All his past staff will mourn his passing, and not the least will be the remnants of that small band of men who worked under him at the beginning of the Cambridge period. None can deny a debt of gratitude for what J. B. did on their behalf, and as long as they live they must surely remember him.

"Death, be not proud, though some have acalled thee
Mighty and dreadful, for thou art not so."

* * * * *

A PIONEER WANTED

Would any young veterinarian be interested in an unusual and interesting post in Nigeria?

The agricultural authorities there are about to start the development of an area of some 14,000 acres of open bush country as a beef cattle ranch. Hitherto it has been almost devoid of cattle because of tsetse, but it is now believed that with the help of various drugs cattle can be reared satisfactorily. A start is to be made with relatively small numbers of cattle and the first five to ten years of the project are to be devoted to building up the herd to a considerable size. There is ample feed available and experiments are to go on in assessing the carrying capacity of this type of country and in introducing new grasses, systems of management, etc., to obtain maximum production. The authorities feel that the best person to undertake management of the project would be one who has been trained with emphasis on veterinary work, with some general knowledge or appreciation of range pasture work in addition.

The main factor which has inclined the authorities in favour of a young veterinarian is the severe disease situation which obtains. The work will be onerous and will call not only for expert knowledge but for considerable initiative and force of character.

The commencing salary will be in the range of £1,000 a year, together with a house, free passage, etc., and the suggested initial contract is for a period of three years. Anyone interested is invited to make contact with the Director of Agriculture, Headquarters Office, Western Region, Dept. of Agriculture, Ibadan, Nigeria, W. Africa.

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ROYAL COLLEGE OF VETERINARY SURGEONS

List of Successful Candidates

Edinburgh

Second Examination:

Dodson, G. R.; Hartley, E. G.

Third Examination:

Brown, Miss D. D.; Brunton, A. S.; Camden-Smith, M. J. (A); Cameron, D. C. K.; Clark, Miss N. D. (A) (H); Coutts, Kenneth; Cribb, P. H.; Easingwood, D. E.; Griffiths, P. H. M. (A); Gyi, K. K.; Harkness, Michael; Hastie, Hamish; *Imlah, Peter; Ironside, J. B. R.; Johnson, D. E.; Jones, J. H. (A); Lamont, P. H. (A); *Lawrence, J. A.; Leitch, I. D. C. M.; *Macdonald, D. C.; McFerran, J. B. (H); McHugh, T. M.; McIntosh, S. A.; Maasri, K. J.; Matthews, R. G.; Miller, J. K. (A); Morrish, J. S. H.; Pratt, D. A.; Prior, J. G.; Rowland, A. C. (A); Rowland, James; Sedgwick, J. R. W.; Stephens, M. B.; Todd, R. H.; Tordoff, D. B.; Wastie, Miss P. C. (A); Whitmore, M. M. (A); Wilson, G. A. (A).

*—denotes 2nd class honours.

(A)—denotes credit in Anatomy.

(H)—denotes credit in Hygiene, etc.

Fourth Examination:

Aston, P. K.; Barnes, Miss P. C. (Paras); Barr, T. R. B.; *Borthwick, Ramsay; Cathcart, R. A.; Christie, R. F.; Couttie, Peter; Dickson, James; *Edwards, Miss M. E.; Findlay, C. R.; Forsyth, D. W.; Garden, Sigurd; Gripper, J. N.; *Haith, C. F.; Irving, Miss P. M.; Jones, D. F.; Levack, Miss M. E. S.; Manktelow, D. B. S.; Muirhead, R. M.; Murphy, O. M. G.; Parminter, Donald (Path); Paterson, R. C. G.; Pill, A. H.; *Podd, G. H.; Poole, Anthony; Raditapole, N. N.; Ramachandran, P. K.; Shields, W. G.; Spence, J. B.; Steele, R. B. T.; *Sutherland, I. H.; Taylor, J. C.; Teale, P. C.; Tennant, L. D.; Watson, A. R. A.; Watt, I. M.; Wittrick, D. A.

*—denotes 2nd class honours.

(Path)—denotes credit in Pathology.

(Paras)—denotes credit in Parasitology.

Final Examination:

Archibald, D. R. N.; Baird, A. C.; Baird, R. G.; Barlow, R. M. (S); Campbell, H. M.; Chong, S. N. (M); Clarke, Miss C. E.; Cock, E. V.; Crocker, R. W.; Dakin, G. W.; Davidson, H. J.; Ferguson, A. R.; Fraser, Donald; Fraser, D. G. (M); Fraser, J. A.; Gilchrist, Miss H. G. R.; Gould, C. M.; Green, W. C.; Griffiths, T. G. G.; Guilor, Miss Mary; Hands, R. R. (M); Hayes, Hilton; Hunt, D. T.; Hutton, P. H.; Jenkins, O. D.; Kermack, N. R.; Lal, G. S. (M); McCulloch, A. F.; MacKay, A. F.; McLaren, A. F. B.; Nelson, A. M. R.; Peden, A. B.; Reid, G. S.; Scoggins, Miss J. M. T. (M); Shannon, David; Sharratt, R. K.; Siller, W. G. (M); Spencer, G. A. (M); Stevenson, R. B.; Stewart, A. F.; Taylor, A. R.; Thorne, J. P.; Vizard, D. J.; Walker, A. I. T.; Watson, H. B.; Watson, Michael; Wetherill, G. D. (M); Windsor, Miss M. D. (M); Wright, Daniel.

(M)—denotes credit in Medicine.

(S)—denotes credit in Surgery.

DEGREES AT EDINBURGH

At the Graduation Ceremonial held by the University of Edinburgh on July 8th, the following degrees were conferred:—

D.Sc. in Veterinary Science:

Alexander, Frank, PH.D., M.R.C.V.S. Thesis: "An Experimental Study of the Digestive System of the Horse."

Dr. Alexander qualified at the Royal (Dick) School in 1940, and is now Senior Lecturer in the Department of Veterinary Pharmacology.

B.Sc. in Veterinary Science:

Archibald, Douglas Randolph Niall, M.R.C.V.S.; Barlow, Richard Moyes, M.R.C.V.S.; Clarke, Coryn Elizabeth, M.R.C.V.S.; Cock, Everard Vaughan, M.R.C.V.S.; Crocker, Roy William, M.R.C.V.S.; Davidson, Hugh Johnstone, M.R.C.V.S.; Fraser, Donald, M.R.C.V.S.; Fraser, Donald Gordon, M.R.C.V.S.; Fraser, Joseph Athol, M.R.C.V.S.; Gould, Colin Michael, B.A. (CANTAB.), M.R.C.V.S.; Green, Walter Clifton, M.R.C.V.S.; Hands, Roy Reginald, M.R.C.V.S.; Hunt, Douglas Trevor, M.R.C.V.S.; MacKay, Alexander Ferguson, M.R.C.V.S.; McLaren, Alexander Petrie Bayne, M.R.C.V.S.; Nelson, Arthur Michael Rex, M.R.C.V.S.; Peden, Andrew Baird, M.R.C.V.S.; Reid, Gordon Stewart, M.R.C.V.S.; Shannon, David, M.R.C.V.S.; Sharratt, Robert Keith, M.R.C.V.S.; Siller, Walter George, DR. MED. VET. (VIENNA), M.R.C.V.S.; Stevenson, Robert Bruce, M.R.C.V.S.; Taylor, Alan Reed, M.R.C.V.S.; Thorne, Joseph Peter, M.R.C.V.S.; Walker, Arthur Ian Tweddle, M.R.C.V.S.; Watson, Hugh Black, M.R.C.V.S.; Wetherill, George Douglas, M.R.C.V.S.; Wright, Daniel, M.R.C.V.S.

The above 28 B.Sc. graduates qualified M.R.C.V.S. at the R.C.V.S. Examinations held this month.

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ADDRESSES OF DISEASE-INFECTED PREMISES

The list given below indicates, first, the county in which are situated the premises on which disease has been confirmed, followed by the postal address and date of outbreak.

Anthrax:

East Suffolk.—Mill Bungalow, Rectory Street, Halesworth, Church Farm, Halesworth (July 7).

Leics.—Loddington Hall, Leicester (July 7).

York (W.R.).—Reeness, Goole (July 7).

Fowl Pest:

Devonshire.—Dowland Mill, Dowland, Dolton, Winkleigh (July 6).

Lancs.—Douglas House, Coe Lane, Tarleton, Preston (July 6).

Leics.—Kingstand Farm, Kirby Muxloe (July 8).

Staffs.—47, Kitling Green Lane, Burton-on-Trent (July 7).

Swine Fever:

Breconshire.—Pantscallog Farm, Sennybridge (July 5).

Cambs.—R. C. Dearsley's premises, Cambridge Road, Bottisham (July 5).

Ches.—Folly Field, Benty Heath Lane, Hoolton, Wirral (July 5); Frog Hall Lane Farm, Broomedge, Lynn, Warrington (July 7); Home Farm, Moss Lane, Lostock Graham, Northwich (July 6).

Essex.—Paradise Farm, Hamlet Hill, Roydon (July 5).; 2, Crow Lane, Romford (July 6).

Gloucs.—Walton Cardiff Farm, Walton Cardiff, Tewkesbury (July 5).

Hants.—"Chenies," Headley, Bordon (July 10).

Herts.—The Spinney, Bayford, Hertford (July 5); Chesterfield, Mays Lane, Barnet (July 5); Burton Grange, Rags Lane, Goffs Oak, Waltham Cross (July 5).

Isle of Ely.—Witcham Toll Garage, Sutton, Ely (July 5).

Kent.—Moatlands Farm, Marden (July 6).

Lancs.—Breakneck Farm, Haighton, Grimsargh, Preston (July 5); Warren Farm, Southport Road, Formby, Liverpool (July 6); Island Farm, Nateby, Preston (July 6); Dagnalls Green Farm, Crank Road, St. Helens (July 9); Peasley Cross Lane, St. Helens (July 9).

Mont.—Garafon, Cornmins Coch, Machynlleth (July 5); 2, Stalloe Holdings (July 10).

Norfolk.—Bells Farm, Antingham (July 7).

Salop.—Moreton Cottage, Cound, Shrewsbury (July 9).

Staffs.—Grange Farm, Amerton, Stafford (July 7).

Somerset.—Moat Farm,Marston Bigot, Frome (July 6).

Suffolk (W.).—Symonds Farm, Gt. Saxham, Bury St. Edmunds (July 7); Potts Farm, Layham, Hadleigh (July 8).

Sussex.—Golf Farm, Dyke Road, Hove, Brighton (July 6).

Sussex (E.).—York House Farm, Hallard, Lewes (July 7).

Wilts.—1, Pye Corner, Atworth, Melkham (July 8); Mill Farm, Hill Deverill, Warminster (July 5).

CORRESPONDENCE

The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the B.V.A.

RABIES IN SOUTH AFRICA

Sir,—On page 386 of the issue of July 3rd is a short, and somewhat misleading, agency report headed "Rabies in South Africa."

The second of the two sentences reads "Several Africans have died through being bitten by rabid dogs, but although several Europeans have caught the disease all have survived." These two statements invite the reader to infer that: (i) Africans are more susceptible to rabies than Europeans, and (ii) Europeans can "catch" the disease and survive.

It is doubtful whether either inference is justified. Such evidence as was produced in the Rabies section of the VIth International Microbiological Conference in Rome in September last suggested that, if anything, the dark-skinned races were less susceptible than light-skinned ones, although the difficulty of proving, or refuting, such a contention needs no stressing.

As to whether Europeans, or anyone else, can "catch" rabies and survive depends less on the defence mechanism of the afflicted than on the definition of "catching rabies." In the context it can only mean "exposure to": any other interpretation must be rejected in the absence of further details. On rare occasions claims have been made that humans have recovered from clinical rabies, but the accompanying evidence has not always been convincing.—Yours faithfully, C. W. Wells, Veterinary Department, H.Q., Kuala Lumpur, Malaya. *July 6th*, 1954.

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APPOINTMENTS IN NEW ZEALAND

Sir,—I must reply to Mr. J. A. Toovey's letter of April 10th appearing in *The Veterinary Record* received here to-day, as he seems to have been most unfortunate in his experiences and hardly presents a true picture of the veterinary profession in New Zealand.

In no way is the profession, represented by the New Zealand Veterinary Association, controlled by the State or by lay persons. Regarding "very close control of the individual" no one I have met here has ever been restricted in any way in his professional work in club practice, and, incidentally, is not distracted in this by the worry of collection of accounts.

Members meet on most friendly terms and are colleagues in the true sense of the word. All members are encouraged to attend branch meetings and conferences, expenses being met by the club.

Salaries rise automatically from £900 to £1,200 and there are quite a large number who receive salaries above £1,200.

Car allowance at 8d. per mile is adequate though more is payable if it can be shown necessary. In no case need any one suffer financial loss. Many clubs give financial assistance to graduates for purchasing cars.

Other amenities in club practice are modern houses at low rentals, instruments allowance of £30 per year, veterinary magazines provided, ample annual leave, sick pay allowances, and superannuation if desired.

Through the club system alone has the New Zealand farmer been able to benefit on a large scale from the work of the profession and in many districts it is the only feasible system. For this alone the club system should not be condemned.

The advertisements regarding appointments in New Zealand do not indicate a flood of graduates returning, but, rather, the rapid expansion of the club system here. The work is no more arduous than in England and almost no night calls are experienced.—Yours faithfully, A. J. Keay, P.O. Box 450, Rotorua, New Zealand. *June 24th*, 1954.

. . . . .

Sir,—It had been my intention to make no further contribution to the correspondence under this heading. The very misleading statement of the final paragraph of Mr. Skyme's letter has, however, made this intention invalid.

Opportunities for private practice in New Zealand do exist in towns sufficiently large to provide the necessary small animals. Private practice also flourishes in the thoroughbred world.

In agricultural areas, however, the country is now fairly adequately covered by the club movement. Club practice is heavily subsidised and the private practitioner has great difficulty in open competition. For example my own club in New Zealand charged 15s. plus drugs for my first visit, and 10s. a visit thereafter, to all farms in my area, which had a radius of 25 miles. No extra charge was made for difficult calvings, operative procedures, etc. This was, in fact, a moderately high charge, most clubs operating at 7s. 6d. or 10s. for the first visit and nothing thereafter.

I do not know how anyone can commence practice anywhere with "a car and a set of instruments." Even in New Zealand additional outlay would appear to be for a house (£3,000 to £5,000), drugs, equipment, stationery, etc.

Drugs are very freely available to the New Zealand farmers. Penicillin is sold and prominently displayed in chemists', grocers' and confectioners' shops. Indeed "use X's penicillin for your mastitis cases" is heard over the commercial radio. Farmers do their own dehorning (without anaesthetic), milk fevers, etc., and treat interdigital necrosis with sulphamezathine or penicillin.

I once heard a New Zealand pharmacist state that the farmers had cornered the veterinary profession in the Dominion. This is a very true summing up of the situation.—Your faithfully, J. A. Toovey, Church House, St. Neots, Hunts. *July 10th*, 1954.

Advertiser's Announcement

Introduction of Veterinary Intradex

Glaxo Laboratories Ltd. announce the introduction from July 12th of Veterinary Intradex (6 per cent. dextran in normal saline). It will be available in 125 c.c. bottles.

Intradex blood volume expander may be used in such conditions as haemorrhage, burns, surgical operations, vomiting and enteritis—either as a first-aid measure in cases ultimately needing whole blood, or employed as the sole blood volume restorer. Intradex may be stored for long periods without deterioration.